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W90N740 BootLoader User's Manual

June 18, 2003



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Revision History:

Revision	Date	Comment
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1 Boot Loader

When the W90N740 system power-up, the BootLoader is the first program to be executed, it initializes the W90N740 system, do the memory remapping. If no 'ESC' or 'B' key is pressed within a specified period, then the bootloader will scan the images in the flash, load the first active image, transfer the control to this active image.

If the 'ESC' or 'B' key received within 3 seconds, the bootloader get the control, enter bootloader mode, a command shell will get the command input from the terminal emulator by the serial or network connection. It provide the image download, flash programming, memory editing and so on. This document will describe boot loader on the following sections:

- About the boot loader
- The commands provided by the boot loader
- The flash ROM map of the boot loader
- The memory map of the boot loader
- Download procedure examples
- FAQ's



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1.1 About the boot loader

The boot loader is a ROM-based monitor program that communicates with the host computer using commands through a serial or network connection. On the flash ROM, except the bootloader, individual programs can be resided on different images. The image on the flash can be loaded by the bootloader to be executed. The bootloader also provides program download and flash write functions. A program can be downloaded to the system to execute, or directly download it into the flash ROM as a image.

1.1.1 Hardware Connection

The hardware connection to the boot loader could be through the serial port connection, or by network connection.

- *Serial Port Connection*
The serial port is the default communication channel with the host computer.
- *Network Connection*
The network connection is used by the alternate communication channel and TFTP download function.

1.1.1.1 Setting up a serial connection

To communicate with the boot loader on the platform, a terminal emulator program is needed (for example, Windows HyperTerminal, Linux minicom). Connect the serial port on the platform by a serial cable, the terminal emulator must set the serial port setting to:

Baud rate	115200
Data bits	8
Parity	None
Stop bits	1
Flow control	None

1.1.1.2 Setting up a TCP/IP connection

To communicate with the boot loader on the platform through network, a terminal emulator program with network connection support is also required. (For example, Windows HyperTerminal with WinSock support). Connect the platform and the host



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computer to the network, and change the platform ‘debug port’ to network. The terminal emulator must set the network connection settings to:

Host address xxx.xxx.xxx.xxx(The IP address of boot loader on the target,
 such as 192.168.1.100)
Port number 65500

1.1.1.3 Boot loader functions

The boot loader provides a set of functions to do the system configuration, image download, update flash image, and others. These functions include,

- Download images through the serial connection into system memory or flash memory
- Download images into system memory or flash memory through network
- Read and write data in memory
- Configure platform system information
- Enable or disable cache
- Decompress images to the system memory.
- Support network communication channel with host computer



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1.2 Commands of the boot loader

The command interpreter accepts user commands to do the specified operations. The following table lists the commands of the boot loader. Commands can be accepted in uppercase or lowercase.

Command	Comment
H	Display the available commands
B	Set Baud Rate
D	Display memory. D -? for help
E	Edit memory. E -? for help
G	Goto address
MX	Xmodem download
MT	TFTP download
FT	Program the flash by TFTP. T -? for help
FX	Program the flash by Xmodem. P -? for help
CP	Memory copy
LS	List the images in the flash
SET	Setting boot loader configuration. SET -? for help
CHK	Check the flash
RUN	Execute image
DEL	DEL the image or flash block
MSET	Fill memory
TERM	Change the terminal output port
BOOT	Reboot the system
CACHE	Cache setting
UNZIP	Unzip image

1.2.1 H, Show the command list

SYNOPSIS

H

DESCRIPTION

This command is used to list all valid commands provided by boot loader.
For example:

```
bootloader > h
```

All commands will be shown on the terminal emulator with brief descriptions.



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1.2.2 B, Set baud rate

SYNOPSIS

*B [1200] [2400] [4800] [9600] [14400] [19200] [28800] [38400] [57600]
[115200] [230400] [460800]*

DESCRIPTION

This command is used to set the baud rate for the serial line used by the boot loader.

For example:

```
bootloader > b 115200
```

The baud rate changes immediately after the target system baud rate was set. The baud rate setting of the terminal emulator needs to reconfigure to new baud rate setting.

The flow control and stop bits cannot be configured.

1.2.3 D, Display the memory contents

SYNOPSIS

*D -{w,h,b,s} [taddr]
-w, -W Word alignment
-h, -H Half-word alignment
-b, -B Byte alignment
-s, -S Swap target
[taddr] Target memory address.*

DESCRIPTION

This command displays 256 bytes of system memory by the specified address. The data format shown on the terminal emulator could be 32, 16 or 8 bits. That could be specified by command options such as '*w*', '*h*', or '*b*'. The '*w*' option lets the command show the system memory in words (4 Bytes). The '*h*' option lets the command show the system memory in half-words(2 Bytes). The '*b*' option lets the command show the system memory in bytes. An example of this command is shown as follows:

```
bootloader > d -w 0x8000
Displaying memory at 0x8000
[00008000] FFFFE9FB FEEFF9FD - FFFF7ABD FFFFFFF9E .....z.....
[00008010] 5ECB8FFF F5ABE579 - CFFFFBF6 FFBDFEEF ...^y.....
[00008020] EFEFBFFE B4FFFFB7 - 7DFCFFEE BF9FDFFD .....}....
[00008030] CEF7EAFF9 FFE3FB7D - FFFCEFF7 FFEBFFF8 .....}.....
```



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[00008040]	E76E9EFF	ABDEF78E	-	3DF7FFF5	FBD9EDF3	. . n = . .
[00008050]	EFDEBEFF	F25B5FD9	-	FF7F6F5F	E9F6F2AF _ [. _ o □ . . .
[00008060]	BFED7EFF	F3F7D79A	-	FCF3DEFF	999B3FBF	. ~ ; . .
[00008070]	FFFBF5DF	F7FFF7EE	-	7EFFFFFDB	FDB95BEF ~ [. .
[00008080]	FDFFFFBB7	D8BFDF6D	-	BDFEFDFD	F77FED77 m w . □ .
[00008090]	DF7FBFFD	DF7FEFFF	-	7FDFCEF7	DFFEFF77F	. . □ . . □ . . . □ . . .
[000080A0]	95FBF77F	6BBFF7F7	-	5FF5D776	FEFFD9F7	□ kv . . . _ .
[000080B0]	FFFFFFFFFFB7	BFBFFFFF7	-	FBFFFEBD	BFF7BE7F □ . . .
[000080C0]	F6CDBBD4	7FDD3DFF	-	FF5FFD7F	53FDE77F = . □ . . _ . □ . . S
[000080D0]	DD56F7DE	4EEFF33F	-	FBEEFFBB	F7B7F7DF	. . V . ? . N
[000080E0]	FBE7F7F7	FFFDEDFA	-	6EBFFEFA	AFB2FFDE n . . .
[000080F0]	7FFFFFFF	7CFF77BB	-	DDE5FBF7	FF7BFEFF	. . □ . w { .

1.2.4 E, Edit the system memory

SYNOPSIS

<i>E</i>	$-[w,h,b,s]$	<i>[taddr]</i>
	$-w, -W$	<i>Word alignment</i>
	$-h, -H$	<i>Half-word alignment</i>
	$-b, -B$	<i>Byte alignment</i>
	$-s, -S$	<i>Swap target</i>
	<i>[taddr]</i>	<i>Target memory address.</i>

DESCRIPTION

This command edit the data on the target memory address, both the data and address are by hex decimal format. The data width edited could be 32, 16 or 8 bits. They are specified by command options ‘w’, ‘h’ and ‘b’. The ‘w’ option specifies the word access (4 Bytes). The ‘h’ specifies the half-word access (2 Bytes). The ‘b’ specifies the byte access. The example is shown as the follows:

```
bootloader > e -b 0x8000  
[8000] 90 -> 90  
[8001] 80 -> 80  
[8002] 8F
```

The original data at the specified address will be shown in hex before you change it. You can use backspace key to erase the original hex number if you want to change it. The actual contents of the specified memory won't change until you press 'Enter'. The boot loader will step to next memory to edit once the 'Enter' key was pressed. Press the 'ESC' to exit if all modifications have been done.

1.2.5 G, Go to address



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SYNOPSIS

G [address]

DESCRIPTION

This command transfers control to the specified address. Use hex format of the address.

For example:

```
bootloader > g 0x8000
```

The boot loader will transfer control to the given address.

1.2.6 MX, Download to system memory by Xmodem

SYNOPSIS

MX [download address]

DESCRIPTION

Use this command to download an image into RAM on the specified address. The protocol to communicate with the host computer is by the Xmodem on the serial connection.

When the Xmodem download procedure start, the boot loader will continue to send 'C' characters. At this time the image can be downloaded to the platform by Xmodem. If the user wants to cancel the downloading procedure, press Ctrl-x to stop it.

To download a file into address 0x8000:

1. Type **mx 0x8000** at the prompt.
2. Use the **Transmit File** command of your terminal emulator to send the file. If the emulator has more transfer options, use the **Xmodem protocol**.

```
bootloader > mx 0x8000
Press Ctrl-x to cancel ...
CCCCCCCC
Download successed!
```

1.2.7 MT, Download to system memory by TFTP

SYNOPSIS

MT [download address]

DESCRIPTION



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Use this command to download an image into RAM to the specified address. The protocol communicates with the host computer is TFTP. However, on the TFTP process, it needs to set to the '**binary**' transfer mode.

The IP address of the tftp server could be fixed or gotten from the DHCP client.. It is configured according to the boot information block of bootloader.

To download a file into 0x8000:

1. Type `mt 0x8000` at the prompt.
2. Use the tftp client in the host computer to send the file. The tftp client must be set to binary mode to transfer the file. (such as, '`tftp -i 10.3.29.41 put hello.exe`', '-i' is used to set to binary transfer mode)

```
bootloader > mt 0x8000
Wait for auto-negotiation complete...OK
100MB - Full Duplex
DHCP DISCOVER...
DHCP REQUEST...
DHCP ACKed...
IP Address. . . . . : 10.3.29.41
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.3.1.254
```

1.2.8 FX, Load an image into flash by Xmodem

SYNOPSIS

`FX [ImageNo.] [ImageName] [base address] [exec address] -[a,c,x,f,z]`

- `-a` Active image
- `-c` Image needs to be copy to RAM
- `-x` Executable image
- `-f` File system image
- `-z` Compressed image

DESCRIPTION

This command downloads an image into memory by Xmodem and then programs it into flash. As part of the programming process, the bootloader will build flash image footer according to the image characteristic. In order to build the correct footer information, the relative information of the image must be specified. The information is:

- *Image number:*
A unique number for the image.
- *Image name:*
The name of the image, up to 16 characters.



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- *Image base address*
The actual start address of the image on flash
- *Image load address*
The final address when the image executes, it maybe the RAM or flash address. If the final image is executed on flash, the 'Image base address' and 'Image load address' should set to the same address.
- *Image attribution*
The attributes of the image. Boot loader will use these attributes to decide how to process the image on loading it. Such as coping it to memory, executing it, or decompressing it to system memory.

To load an image into flash:

1. Decide the image number, image name, image base, image load address, and image attributes. Ex: 1, demo_image, 0x7f020000, 0x8000, -acx
2. Type **fx 1 demo_image 0x7f020000 0x8000 -acx** at prompt
3. Use the **Send File** command of your terminal emulator to send the file. If the emulator has more transfer options, use the **Xmodem protocol**.

```
bootloader > fx 1 demo_image 0x7f020000 0x8000 -acx
Press Ctrl-x to cancel ...
CCCCCCCCCCCCCCCC
Flash programming ...
```

1.2.9 FT, Load an image into flash by TFTP

SYNOPSIS

<i>FT</i>	<i>[ImageNo.] [ImageName] [base address] [exec address] -[a,c,x,f,z]</i>
- <i>a</i>	<i>Active image</i>
- <i>c</i>	<i>Image needs to be copy to RAM</i>
- <i>x</i>	<i>Executable image</i>
- <i>f</i>	<i>File system image</i>
- <i>z</i>	<i>Compressed image</i>

DESCRIPTION

This command downloads an image into memory by TFTP and then programs it into flash. As part of the programming process, it will build an appropriate flash image footer. In order to build the footer information, the relative information of the downloaded image must be specified. The information is:

- *Image number*
A unique number for the image



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- *Image name:*
The name of the image
- *Image base address*
The actual address of the image on flash.
- *Image load address*
The final address when the image executes, it maybe the RAM or flash address. If the final image is executed on flash, the 'Image base address' and 'Image load address; should set to the same address.
- *Image attribution*
The attributes of the image. Boot loader will use these attributes to decide how to process this image on loading. Such as copying it to memory, executing it, and decompressing it into system memory.

To load an image into flash:

1. Decide the image number, image name, image base, image load address, and image attributions. Ex: 1, demo image, 0x7f020000, 0x8000, -acx
2. Type `ft 1 demo_image 0x7f020000 0x8000 -acx` at prompt
3. Use the tftp client in the host computer to send the file. The tftp client must be set to binary mode to transfer the file. (Such as, 'tftp -i 10.3.29.41 put hello.exe', '-i' is used to set to binary transfer mode)

```
bootloader > ft 1 demo_image 0x7f020000 0x8000 -acx
Wait for auto-negotiation complete...OK
100MB - Full Duplex
DHCP DISCOVER...
DHCP REQUEST...
DHCP ACKed...
IP Address. . . . . : 10.3.29.41
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.3.1.254
```

1.2.10 CP, Copy memory

SYNOPSIS

`CP [saddr] [taddr] [length]`
[saddr] source address to be copied from
[taddr] target address to be copied to
[length] The length of memory block to be moved

DESCRIPTION

This command is used to copy a block of memory. The destination must be in RAM.



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For example:

```
bootloader > cp 0x7f020000 0x8000 0x100000
```

This command will copy the data from 0x7f020000 to 0x8000 with the size 0x100000.

1.2.11 LS, List the images in the flash

SYNOPSIS

LS

DESCRIPTION

This command is used to list the images on the flash. The information of image including image number, image name, image base address, image size, execution address and image attributes. This command can be used to check images position, size and the free space of the flash.

For example:

```
bootloader > ls
Image: 0 name:BOOT INFO base:0x7F010000 size:0x0000FFCC exec:0x7F010000 -f
Image: 1 name:romfs base:0x7F020000 size:0x0009D400 exec:0x00700000 -ac
Image: 2 name:linux base:0x7F0C0000 size:0x000E8250 exec:0x00008000 -acx
```

1.2.12 SET, Set the boot information block

SYNOPSIS

*SET [-net mac [0,1]] [-phy [0,1,2]] [-mac0 [addr]] [-mac1 [addr]] [-ip0 [addr]]
[-ip1 [addr]] [-dhcp [0,1]] [-cache [on, off]] [-buffer [base] [size]]*

DESCRIPTION

The boot information block is used to store the basic configuration of the platform. It includes the Ethernet port used by TFTP server, the MAC PHY chip, the Ethernet MAC address, the IP address, cache ON/OFF, and boot loader buffer address. **The system must be rebooted to make the new setting be valid.**

1.2.12.1 MAC server port

It indicates the Ethernet port that used by tftp server. The value could be MAC 0 and MAC 1.

For example:

```
bootloader > set -mac 0
```



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1.2.12.2 Network PHY chip

This option decides the PHY chip used by the MAC. The setting could be DAVICOM DM9161E, IC PLUS IP175A, and MARVELL 88E6052. Their value are as follows:

DAVICOM_DM9161E	= 0
IC_PLUS_IP175A	= 1
MARVELL_88E6052	= 2

For example (Setting to IC_PLUS_IP175A):

```
bootloader > set -phy 1
```

1.2.12.3 MAC 0 Address

This is the network address for the MAC0

For example:

```
bootloader > set -mac0 00:11:22:33:44:55  
or  
bootloader > set -mac0 001122334455
```

1.2.12.4 IP 0 Address

This is the fixed IP address for the MAC0.

For example:

```
bootloader > set -ip0 192.168.1.1
```

1.2.12.5 MAC 1 Address

This is the network address for the MAC1

For example:

```
bootloader > set -mac1 00:11:22:33:44:55  
or  
bootloader > set -mac1 001122334455
```

1.2.12.6 IP 1 Address

This is the fixed IP address for the MAC1.

For example:



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```
bootloader > set -ip0 192.168.1.1
```

1.2.12.7 DHCP Client

If this option is enabled, the IP address used by boot loader will be got from the DHCP server. If it is disabled, the boot loader will use fixed IP address.

For example (Disable DHCP client):

```
bootloader > set -dhcp 0
```

1.2.12.8 BL buffer base

When using TFTP server, network console, SET command or decompression function, the boot loader needs additional memory space to do it. The address of the ‘buffer base’ used by the bootloader must ensure that it would not make conflict on doing the TFTP server downloading, network console, or decompression function. This option indicates the base address of the free space for boot loader. The buffer base must be set with buffer size.

1.2.12.9 BL buffer size

This option indicates the size of the free space reserved for boot loader. The buffer size is recommended to be 0x100000.

For example(base=0x300000, size=0x100000):

```
bootloader > set -buffer 0x300000 0x100000
```

1.2.13 **CHK, Check the flash space**

SYNOPSIS

CHK

DESCRIPTION

This command is used to check if there are unknown data in flash. If there is unknown data in flash, the flash programming function may be failed. Therefore, the user could use this command to check if contents of the flash are clean.

For example:

```
bootloader > chk
```



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1.2.14 RUN, Execute image

SYNOPSIS

RUN *[image number]*

DESCRIPTION

This command is used to execute an image. The command will process the image according to the attributes of the image.

For example (Execute image 1):

```
bootloader > run 1
```

1.2.15 Del, Delete the image or flash block

SYNOPSIS

DEL *[ImageNo.] [block] [-all]*
 [ImageNo.] Delete the image
 [block] Delete the block
 [-all] Delete all blocks

DESCRIPTION

This command is used to delete the image from the flash. If the image number is given, this command will delete the specified image. If the block number is given, this command will only erase that block. You also can use this command to erase all blocks in the flash except block 0 and 1 with the option -all. The size of each block is 64KB. If the flash size is 2MB, there would be 32 blocks in the flash. These blocks are from block 0 to 31.

For example:

```
bootloader > del 1
```

Delete the image 1

```
bootloader > del b1
```

Delete the block 1 of the flash

```
bootloader > del -all
```

Erase all blocks in the flash except block 0 and 1

1.2.16 MSET, Fill memory

SYNOPSIS

MSET *-[w,W,H,h,B,b] [saddr] [size] [value].*



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<i>-w, -W</i>	<i>Word alignment</i>
<i>-h, -H</i>	<i>Half-word alignment</i>
<i>-b, -B</i>	<i>Byte alignment</i>
<i>[saddr]</i>	<i>Start address to be filled from.</i>
<i>[size]</i>	<i>Size of the memory to be filled.</i>
<i>[value]</i>	<i>The value to be filled into memory.</i>

DESCRIPTION

The MSET command fills a block size of memory with the specified value. This value could be word, half-word, or byte. There options are **-w**, **-h**, **-b**. The default is word.

For example:

```
bootloader > mset 0x8000 0x400000 0x12345678
```

Fill 0x12345678 to address 0x8000 by word(4 bytes) with the length 0x40. The memory contents should become:

```
Displaying memory at 0x8000
[00008000] 12345678 12345678 - 12345678 12345678 xv4.xv4.xv4.xv4.
[00008010] 12345678 12345678 - 12345678 12345678 xv4.xv4.xv4.xv4.
[00008020] 12345678 12345678 - 12345678 12345678 xv4.xv4.xv4.xv4.
[00008030] 12345678 12345678 - 12345678 12345678 xv4.xv4.xv4.xv4.
```

```
bootloader > mset -b 0x8000 0x40 0x1234
```

Fill 0x1234 to address 0x8000 by byte with the length 0x40. The memory contents should become:

```
Displaying memory at 0x8000
[00008000] 1234 1234 1234 1234 - 1234 1234 1234 1234 4.4.4.4.4.4.4.4.
[00008010] 1234 1234 1234 1234 - 1234 1234 1234 1234 4.4.4.4.4.4.4.4.
[00008020] 1234 1234 1234 1234 - 1234 1234 1234 1234 4.4.4.4.4.4.4.4.
[00008030] 1234 1234 1234 1234 - 1234 1234 1234 1234 4.4.4.4.4.4.4.4.
```

1.2.17 TERM, Change the debug channel

SYNOPSIS

TERM [0] [1]
[0] *Serial port output*
[1] *TCP/IP output*

DESCRIPTION

The boot loader supports an alternate debug communication channel to host computer. The user can use this command to switch to another debug channel. The option 0 is to switch to serial port and the option 1 is to switch to network connection. For example:

```
bootloader > term 0
Switch to serial port connection
```



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```
bootloader > term 1  
Switch to network connection
```

1.2.18 **BOOT, Reboot the system**

SYNOPSIS

BOOT

DESCRIPTION

The *BOOT* command will make a software reset of W90N740 to reboot the system immediately.

For example:

```
bootloader > reboot
```

1.2.19 **CACHE, Setting cache**

SYNOPSIS

CACHE -[on,off,f]
 -on, off Enable/Disable cache
 -f Flush cache

DESCRIPTION

This command is used to enable or disable the cache. The option are:

- on Enable the cache
- off Disable the cache

For example:

```
bootloader > cache -on
```

1.2.20 **UNZIP, Decompress the image**

SYSNOPSIS

UNZIP [*ImageNo.*]

DESCRIPTION

The *UNZIP* command can decompress an image of the given image number into system memory according to the load address recorded on the image footer.

For example:

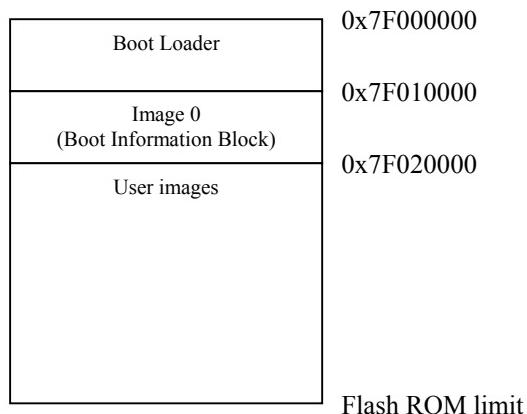


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bootloader > unzip 1

1.3 The flash ROM map of the boot loader

The boot loader is used to boot the system and load the user program to execute. Therefore, the boot loader must be located in the offset zero of the flash. The minimum space requirement of boot loader is 128KB. The first 64KB is the program code of boot loader, and the other 64KB is image 0 which is used to store the boot information block of boot loader. If the flash ROM on the system is larger than 128KB, the other space is used to store the user's images. The flash ROM map is shown as follows:



The boot loader flash map

1.3.1 Boot Loader

The boot loader must be place on the offset zero of the flash. In the platform based on the W90N740, the boot ROM is mapped to the 0x7F000000. Therefore, the boot loader start address is 0x7F000000.

1.3.2 Image 0

All images in the flash ROM have their unique numbers to identify themselves. The image 0 is a special image, which is used to store the boot information. The boot information including:

Name	Size (byte)	Description
length	4	Indicating the length of the information block
type	4	Identify the information block
mac0	6	The network address for MAC 0

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ip0	6	The IP address for MAC 0. The last two bytes are reserved.
mac1	6	The network address for MAC 1
ip1	6	The IP address for MAC 1. The last two bytes are reserved.
cache	4	Setting the cache when loading images
dhcp	4	Setting if the IP address is given by DHCP or not
net_mac	4	Setting if the IP address is given by DHCP or not
phy	4	Setting the PHY chip used by MAC
buf_base	4	The base address of the buffer used by boot loader
buf_size	4	The size of the buffer used by boot loader

If the image 0 does not be found by boot loader, the boot loader will create it at 0x7F010000. A 64KB flash memory size starts at 0x7F010000 should be reserved for image 0.

1.3.3 User images

At the boot time, the boot loader will scan images form image number 1 to 7. If any image found, the boot loader will process it according to the attributes of the image.

1.3.3.1 Image

The image could be binary code or data with the footer information. When the user image is downloaded into flash by boot loader, the boot loader will write the footer with the user image. The location of the footer is always at the end of the last flash block of the image. If there is no enough free space at the end of the last flash block of the image, the footer will be written to the end of the next free block. An example is shown as follows:



All flash space is divided into blocks by the size of 64KB. The user image is stored in these blocks. For an image of size 160KB, it needs at least three blocks to store the image. The footer will be written to the end of the last block.



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1.3.3.2 Footer

The footer is a data structure to store all the information relative to the image. The information in the footer includes:

Name	Size (byte)	Description
num	4	The image number
base	4	The base address of the image
length	4	The image size
load_address	4	The load address of the image.
exec_address	4	The execution address of the image.
name	16	The image name
image_checksum	4	The checksum of the image
signature	4	A signature word to identify a footer
type	4	The attribution of the image
checksum	4	The checksum of the footer

1.3.3.3 Image attribution

The image attributes are stored in the footer. The boot loader will process the image according to the attributes. The attributes and its effect are listed as follows:

- **IMAGE_ACTIVE (0x1) (-a)**
This attribute indicates the boot loader should process this image at booting. If the image is not active, the boot loader will skip it when booting.
- **IMAGE_COPY2RAM (0x2) (-c)**
This attribution indicates the boot loader should copy the image into system memory. The boot loader will copy the image from base address to the load address if the image is active and the IMAGE_COPY2RAM attribution is set.
- **IMAGE_EXEC (0x4) (-x)**
If the IMAGE_EXEC attribute is set, the boot loader will pass its control to the image, i.e., the boot loader will transfer the control to this image. If the user image is a semihosted application, the boot loader can continue to process the next image after the semihosted application terminated. This attribute usually used with IMAGE_COPY2RAM to execute the image in system memory.
- **IMAGE_FILE (0x8) (-f)**



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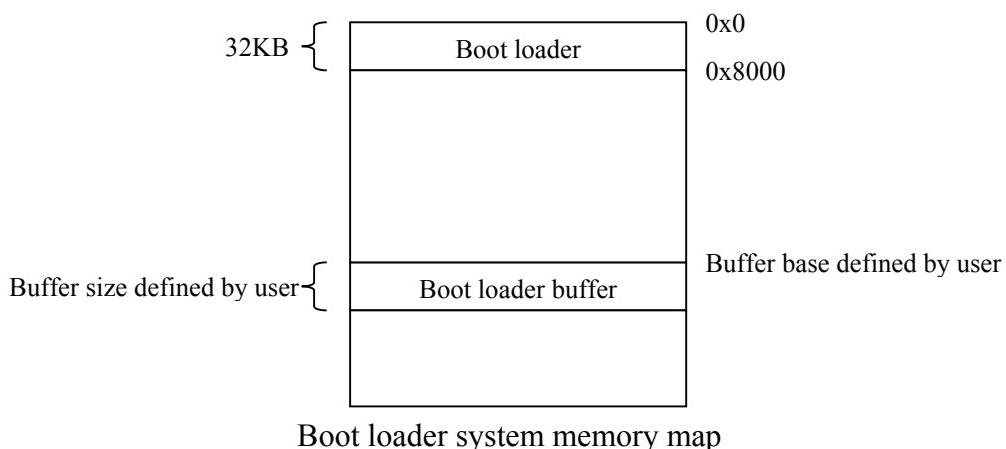
The IMAGE_FILE attribute is used to indicate this image is a file system image. The boot loader doesn't do anything for this image.

- IMAGE_COMPRESSED (0x10) (-z)
The IMAGE_COMPRESSED attribution is used to indicate the image is compressed. The boot loader will decompress the compressed image to load address. The boot loader only support zipped format files.

Some of above attributes could be used together. For example: IMAGE_ACTIVE and IMAGE_COMPRESSED and IMAGE_EXEC will cause the boot loader decompressing the image into system memory and execute it. Therefore several attributes can be set to be active according to the requirement.

1.4 The memory map of the boot loader

The boot loader requires the system memory on the boot loader execution. The required system memory includes two areas. One is 32KB memory size at low memory address start at address 0x0. Another is the buffer area defined by the user. The runtime memory map of the boot loader is illustrated as follows:



1.4.1 32KB memory

The boot loader requires the 32KB memory at low address from 0x0 to 0x7FFF. The memory is used to be as stack, heap and code section of bootloader. This area can't be used by the user program if it wants to return to boot loader control after the program executed.

1.4.2 Boot loader buffer

The boot loader defines a buffer for special usage. This buffer provides the boot loader a larger memory space to accomplish some special functions. The detailed description is as follows:

1.4.2.1 To backup image 0 when setting the boot information

The free space in image 0 can be used to store application data. The boot loader must backup the whole image 0 to prevent data from lost when it programs the boot information into flash. The buffer required to backup the image 0 data is 64KB.



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1.4.2.2 To be the buffer used by network connection

The network connection needs about 64KB memory space to be as the net buffer. Once the boot loader uses the network functions, such as tftp server or network console, this buffer must be provided.

1.4.2.3 To be the buffer used by decompression

The decompression function in the boot loader requires about 50KB memory space to accomplish the function.

1.4.2.4 To be the stack and heap space for semihosted program

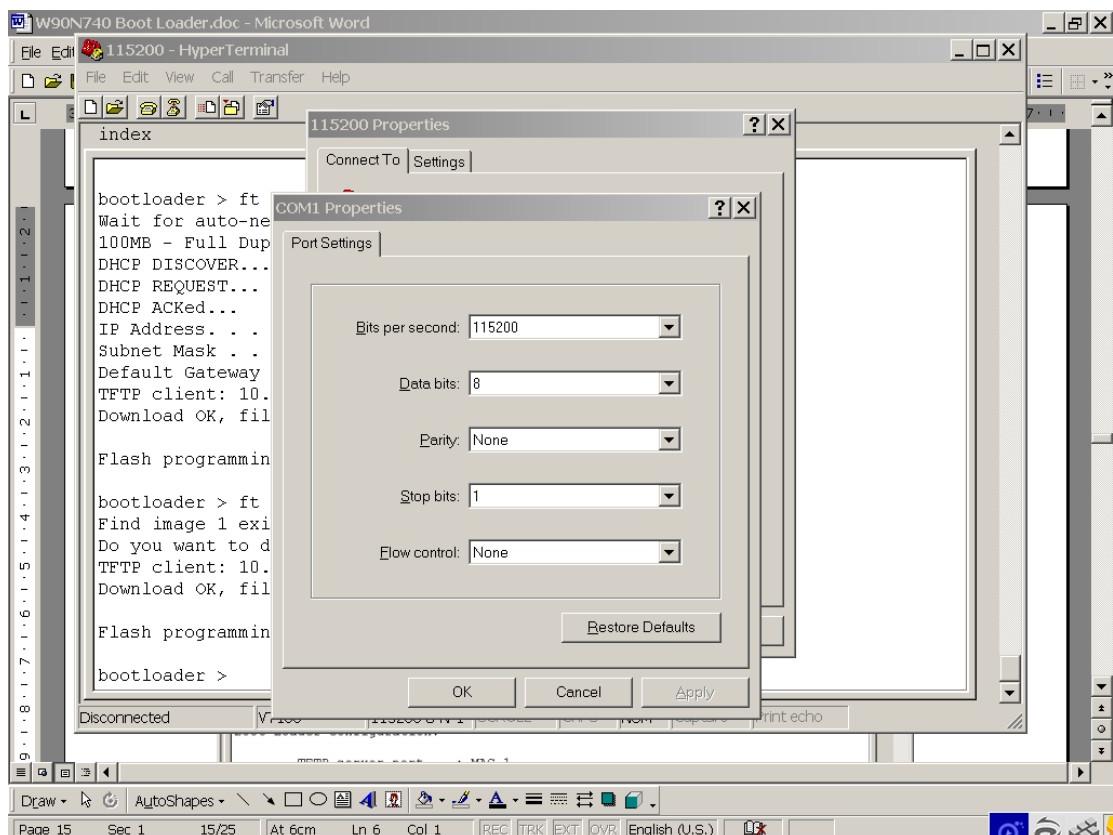
A 128KB stack and a 128KB heap are required for the semihosted program to be executed.

1.5

Download procedure examples

1.5.1 Case 0: How to enter debug mode?

To communicate with the host computer, you need to set the terminal emulator to the proper serial port setting. In Windows' HyperTerminal, the serial port setting illustrated as the following figure. It should be set to baud rate 115200, 8 data bits, no parity, 1 stop bit, no flow control.



If the boot loader is connected correctly to the host computer, there are some messages shown on the terminal emulator when system startup. The boot loader will wait for 3 seconds before loading images. Press ‘ESC’ key or ‘B’ to enter bootloader mode before it time out. The boot screen of boot loader is shown as the followed figure.



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A screenshot of a HyperTerminal window titled "115200 - HyperTerminal". The window displays the "Boot Loader Configuration:" screen. The configuration parameters listed are:

- TFTP server port : MAC 1
- Network phy chip : PHY
- MAC Address : 00:00:CC:DD:AA:11
- IP Address : 192.168.0.228
- DHCP Client : Enabled
- CACHE : Disabled
- BL buffer base : 0x00300000
- BL buffer size : 0x00100000

The message "Press ESC to enter debug mode ..." is displayed at the bottom. Below it, the text "W90N740 Command Shell v0.1 Rebuilt on May 26 2003 at 10:50:20" is shown. The prompt "bootloader > _" is at the bottom of the terminal window. The status bar at the bottom of the window shows "Connected 00:00:16" and other terminal settings like VT100, SCROLL, CAPS, NUM, Capture, and Print echo.

Please press "h" for command reference.

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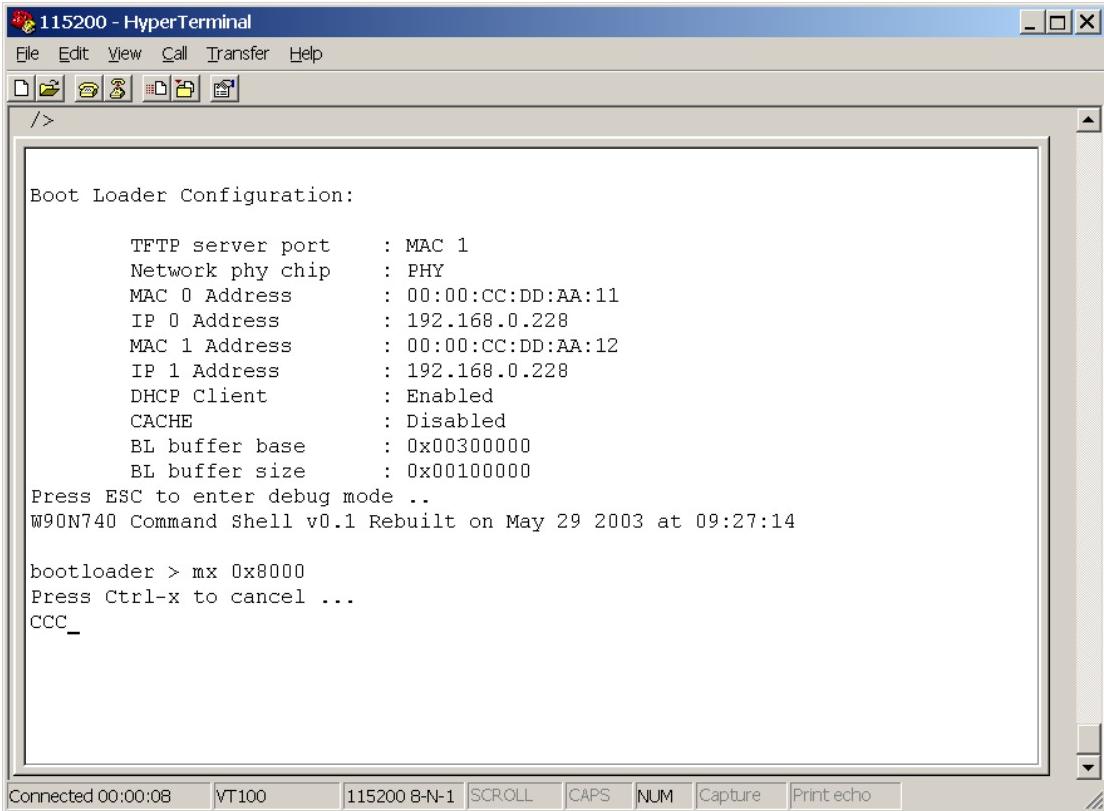
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1.5.2 Case 1: Download an image to memory by Xmodem

- | | |
|-------------|--|
| Description | - Download "demo.bin" to memory 0x8000 |
| Command | - mx 0x8000 |
| Screen shot | - |



The screenshot shows a HyperTerminal window titled "115200 - HyperTerminal". The window displays the following text:

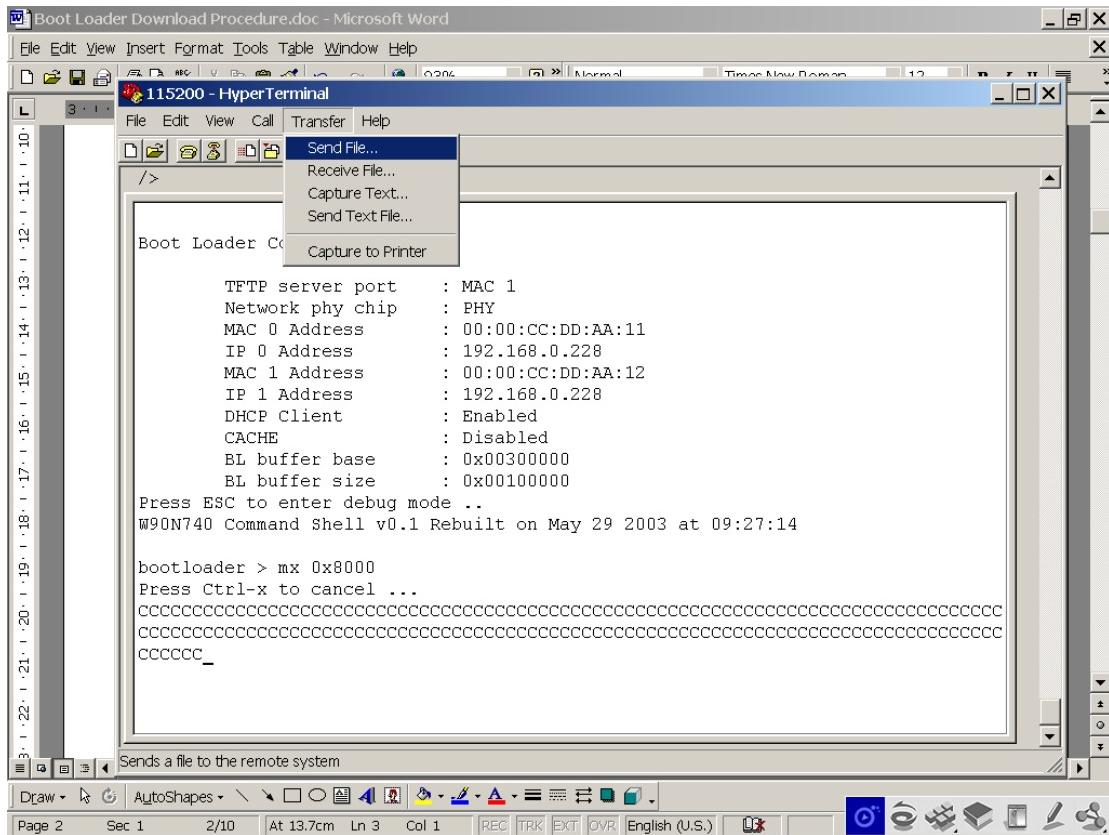
```
Boot Loader Configuration:
TFTP server port      : MAC 1
Network phy chip       : PHY
MAC 0 Address          : 00:00:CC:DD:AA:11
IP 0 Address           : 192.168.0.228
MAC 1 Address          : 00:00:CC:DD:AA:12
IP 1 Address           : 192.168.0.228
DHCP Client            : Enabled
CACHE                  : Disabled
BL buffer base         : 0x00300000
BL buffer size          : 0x00100000
Press ESC to enter debug mode ..
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 09:27:14
bootloader > mx 0x8000
Press Ctrl-x to cancel ...
CCC_
```

At the bottom of the terminal window, there is a status bar with the following information:

Connected 00:00:08 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo



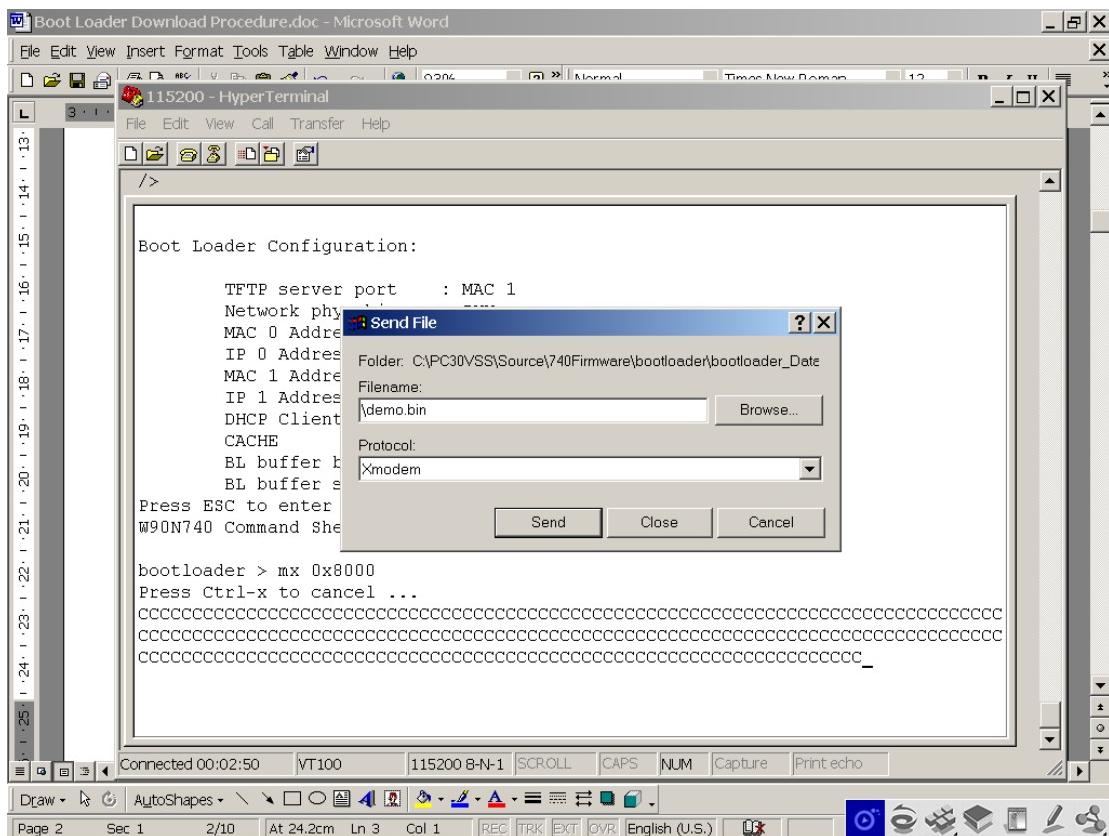
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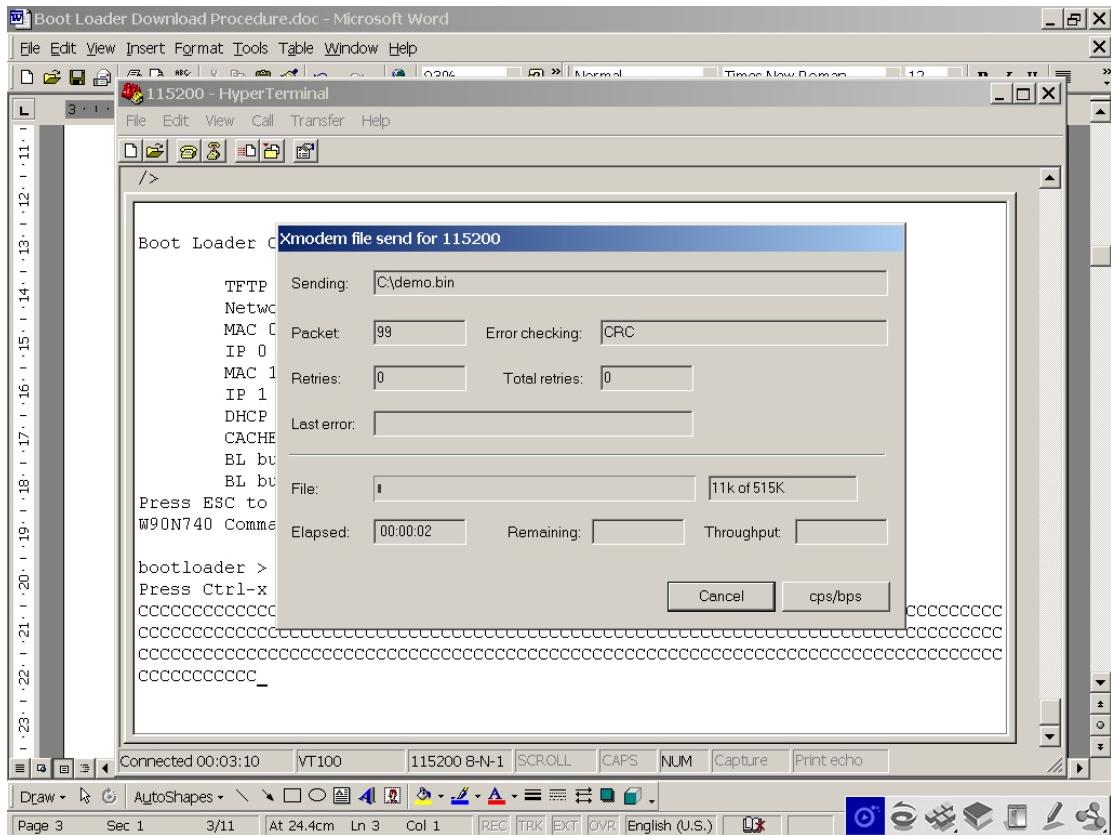
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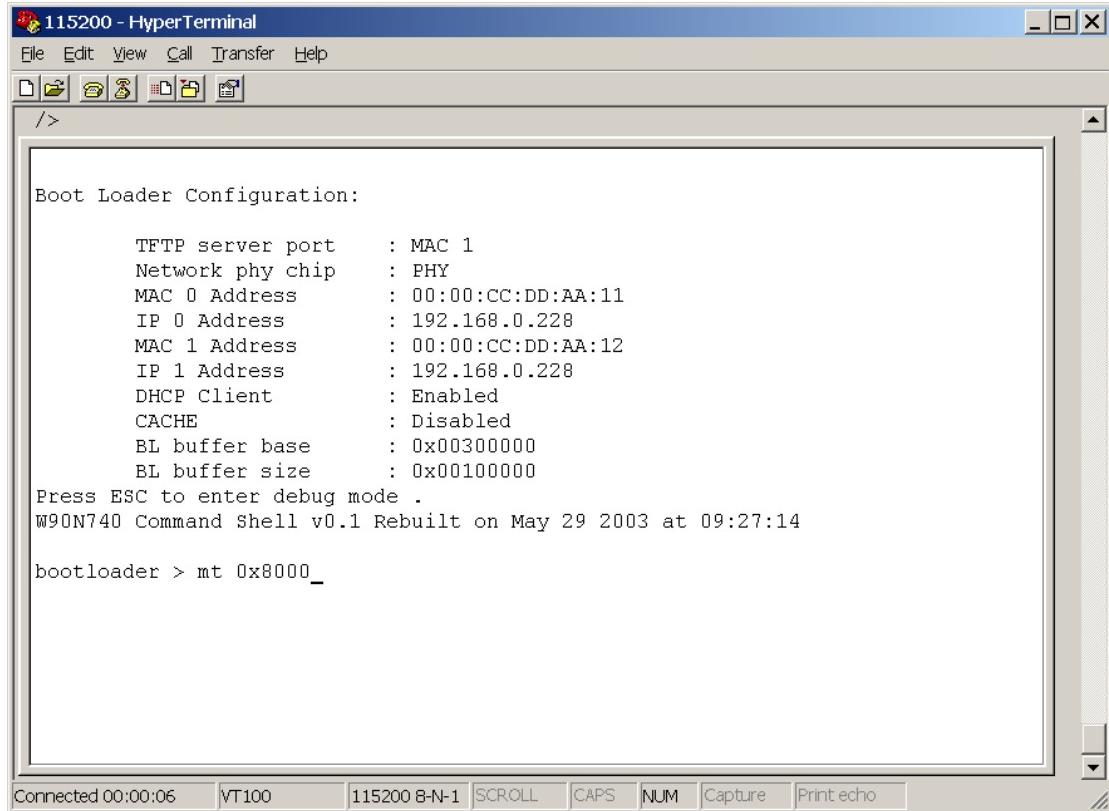


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1.5.3 Case 2: Download image to memory by TFTP

Description - Download "demo.bin" to memory 0x8000
Command - mt 0x8000
Screen shot -



The screenshot shows a window titled "115200 - HyperTerminal". The menu bar includes File, Edit, View, Call, Transfer, and Help. Below the menu is a toolbar with icons for copy, paste, cut, find, etc. The main window displays the following text:

```
/>  
  
Boot Loader Configuration:  
  
TFTP server port : MAC 1  
Network phy chip : PHY  
MAC 0 Address : 00:00:CC:DD:AA:11  
IP 0 Address : 192.168.0.228  
MAC 1 Address : 00:00:CC:DD:AA:12  
IP 1 Address : 192.168.0.228  
DHCP Client : Enabled  
CACHE : Disabled  
BL buffer base : 0x00300000  
BL buffer size : 0x00100000  
  
Press ESC to enter debug mode .  
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 09:27:14  
  
bootloader > mt 0x8000_
```

At the bottom of the terminal window, there is a status bar with the following information: Connected 00:00:06 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo.



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The screenshot shows a Windows HyperTerminal window titled "115200 - HyperTerminal". The window displays the "Boot Loader Configuration:" screen. It lists various parameters and their values, including TFTP server port (MAC 1), Network phy chip (PHY), MAC 0 Address (00:00:CC:DD:AA:11), IP 0 Address (192.168.0.228), MAC 1 Address (00:00:CC:DD:AA:12), IP 1 Address (192.168.0.228), DHCP Client (Enabled), CACHE (Disabled), BL buffer base (0x00300000), and BL buffer size (0x00100000). A message at the bottom says "Press ESC to enter debug mode .". Below this, it shows the command shell output: "W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 09:27:14", followed by the bootloader booting process: "bootloader > mt 0x8000", "Wait for auto-negotiation complete...OK", "100MB - Full Duplex", "DHCP DISCOVER...", "DHCP REQUEST...", "DHCP ACKed...", "IP Address : 10.3.28.115", "Subnet Mask : 255.255.0.0", and "Default Gateway : 10.3.1.254". The status bar at the bottom of the terminal window shows "Connected 00:00:19" and other terminal settings like VT100, SCROLL, CAPS, NUM, Capture, and Print echo.

[Enter in Windows command prompt]

C:>tftp -i 10.3.28.115 put demo.bin

Transfer successful: 527192 bytes in 1 second, 527192 bytes/s

[Or enter in Linux command prompt]

[wschang0@Linux images]\$ tftp 10.3.28.115

tftp> bin

tftp> put demo.bin

Sent 527192 bytes in 1 seconds

tftp>



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The screenshot shows a Windows HyperTerminal window titled "115200 - HyperTerminal". The window displays a command-line interface for a bootloader. The configuration section shows the following parameters:

IP 0 Address	:	192.168.0.228
MAC 1 Address	:	00:00:CC:DD:AA:12
IP 1 Address	:	192.168.0.228
DHCP Client	:	Enabled
CACHE	:	Disabled
BL buffer base	:	0x00300000
BL buffer size	:	0x00100000

Below the configuration, a message says "Press ESC to enter debug mode .". The text "W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 09:27:14" is displayed. The main part of the terminal shows the bootloader performing network operations:

```
bootloader > mt 0x8000
Wait for auto-negotiation complete...OK
100MB - Full Duplex
DHCP DISCOVER...
DHCP REQUEST...
DHCP ACKed...
IP Address. . . . . : 10.3.28.115
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.3.1.254
TFTP client: 10.3.28.143
Download OK, file size:527,192

Download successed!

bootloader >
```

The status bar at the bottom of the terminal window shows the connection details: "Connected 00:00:51", "VT100", "115200 8-N-1", and various terminal control buttons like SCROLL, CAPS, NUM, Capture, and Print echo.



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1.5.4 Case 3: Program image into flash by Xmodem

- Description - Download “rimfs.img” to flash 0x7F020000 as image 1
Command - fx 1 romfs 0x7f020000 0xd00000 –ac
Screen shot -

The screenshot shows a window titled "115200 - HyperTerminal". The menu bar includes File, Edit, View, Call, Transfer, and Help. Below the menu is a toolbar with icons for copy, paste, cut, find, etc. The main window displays the following text:

```
/>  
Boot Loader Configuration:  
TFTP server port : MAC 1  
Network phy chip : PHY  
MAC 0 Address : 00:00:CC:DD:AA:11  
IP 0 Address : 192.168.0.228  
MAC 1 Address : 00:00:CC:DD:AA:12  
IP 1 Address : 192.168.0.228  
DHCP Client : Enabled  
CACHE : Disabled  
BL buffer base : 0x00300000  
BL buffer size : 0x00100000  
Press ESC to enter debug mode .  
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 09:27:14  
bootloader > fx romfs 0x7f020000 0xd00000 -ac
```

At the bottom of the terminal window, there is a status bar with the following information: Connected 00:00:27 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo.



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(Please refer to Case 1 for the detail of Xmodem download procedure)

A screenshot of a HyperTerminal window titled "115200 - HyperTerminal". The window displays a command-line interface for a boot loader. The configuration section shows the following parameters:

```
Boot Loader Configuration:
TFTP server port      : MAC 1
Network phy chip       : PHY
MAC 0 Address          : 00:00:CC:DD:AA:11
IP 0 Address            : 192.168.0.228
MAC 1 Address          : 00:00:CC:DD:AA:12
IP 1 Address            : 192.168.0.228
DHCP Client             : Enabled
CACHE                  : Disabled
BL buffer base          : 0x00300000
BL buffer size           : 0x00100000
Press ESC to enter debug mode
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 10:12:50
```

The window then shows the start of a flash programming session:

```
bootloader > fx 1 romfs 0x7f020000 0xd00000 -ac
Press Ctrl-x to cancel ...
CCCCCCCCCCCC
Flash programming ...

bootloader >
```

At the bottom of the terminal window, there is a status bar with the following information: Connected 00:02:00, VT100, 115200 8-N-1, SCROLL, CAPS, NUM, Capture, Print echo.



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1.5.5 List the images by “ls” command

The screenshot shows a HyperTerminal window titled "115200 - HyperTerminal". The window displays the "Boot Loader Configuration:" screen with various parameters listed. Below this, it shows a command shell session where the user runs the "ls" command to list images in the flash memory.

```
TFTP server port      : MAC 1
Network phy chip       : PHY
MAC 0 Address          : 00:00:CC:DD:AA:11
IP 0 Address           : 192.168.0.228
MAC 1 Address          : 00:00:CC:DD:AA:12
IP 1 Address           : 192.168.0.228
DHCP Client            : Enabled
CACHE                  : Disabled
BL buffer base         : 0x000300000
BL buffer size         : 0x00100000

Press ESC to enter debug mode
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 10:12:50

bootloader > fx 1 romfs 0x7f020000 0xd00000 -ac
Press Ctrl-x to cancel ...
CCCCCCCCCCCC
Flash programming ...

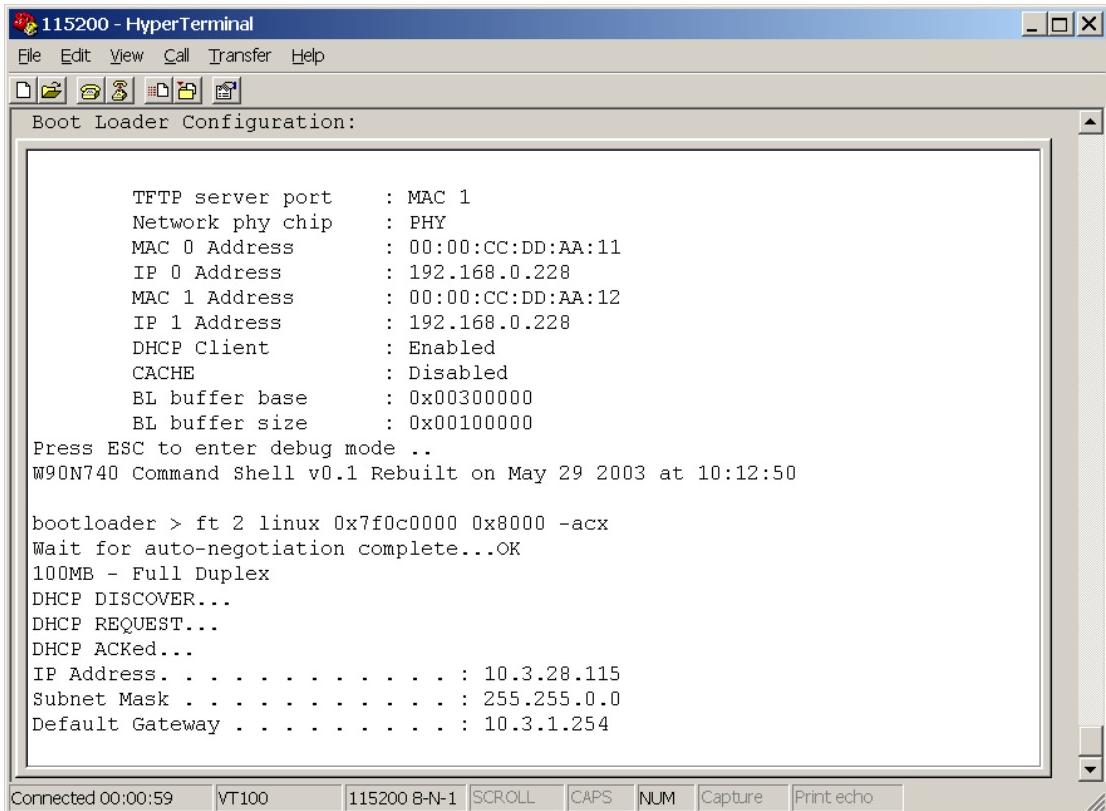
bootloader > ls
Image: 0 name:BOOT INFO base:0x7F010000 size:0x00000038 exec:0x7F010000 -f
Image: 1 name:romfs base:0x7F020000 size:0x0009D400 exec:0x00D00000 -ac

bootloader >
```

At the bottom of the terminal window, there is a status bar with the following information: Connected 00:02:30 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo.

1.5.6 Case 4: Program image into flash by TFTP

Description - Download "linux.bin" to flash 0x7F0C0000 as image 2
 Command - ft 2 linux 0x7f0c0000 0x8000 -acx
 Screen shot -



[Enter in Windows command prompt]

C:\LanCam>tftp -i 10.3.28.115 put linux.bin
 Transfer successful: 950864 bytes in 2 seconds, 475432 bytes/s

[Or enter in Linux command prompt]

[wschang0@Linux images]\$ tftp 10.3.28.115
 tftp> bin
 tftp> put linux.bin
 Sent 950864 bytes in 2 seconds
 tftp>



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The screenshot shows a HyperTerminal window titled "115200 - HyperTerminal". The window displays the following text:

```
IP 0 Address      : 192.168.0.228
MAC 1 Address     : 00:00:CC:DD:AA:12
IP 1 Address      : 192.168.0.228
DHCP Client       : Enabled
CACHE             : Disabled
BL buffer base    : 0x00300000
BL buffer size    : 0x00100000

Press ESC to enter debug mode ..
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 10:12:50

bootloader > ft 2 linux 0x7f0c0000 0x8000 -acx
Wait for auto-negotiation complete...OK
100MB - Full Duplex
DHCP DISCOVER...
DHCP REQUEST...
DHCP ACKed...
IP Address . . . . . : 10.3.28.115
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.3.1.254
TFTP client: 10.3.28.143
Download OK, file size:950,864

Flash programming ...

bootloader > _
```

At the bottom of the window, there is a status bar with the following information:

Connected 00:01:29 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo

List the images by “ls” command



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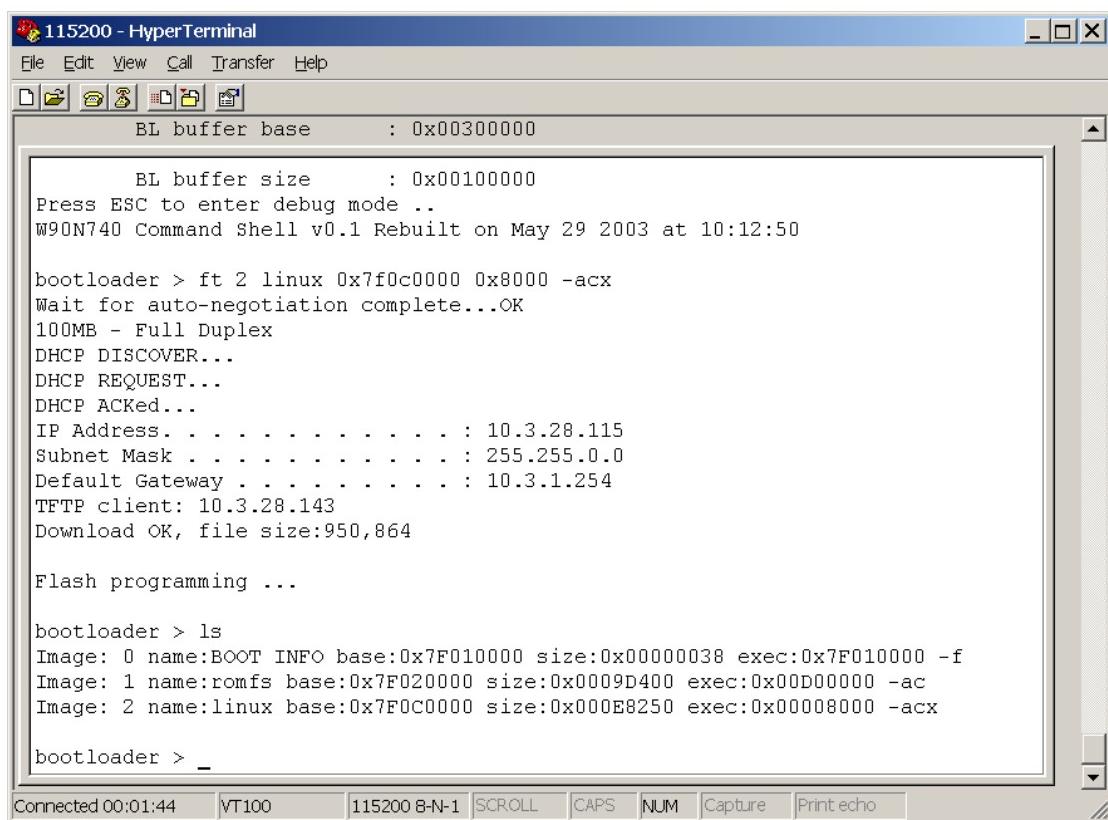
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The screenshot shows a window titled "115200 - HyperTerminal". The menu bar includes File, Edit, View, Call, Transfer, Help. The toolbar has icons for copy, paste, cut, etc. The main window displays the following text:

```
BL buffer base      : 0x00300000
BL buffer size      : 0x00100000
Press ESC to enter debug mode ..
W90N740 Command Shell v0.1 Rebuilt on May 29 2003 at 10:12:50

bootloader > ft 2 linux 0x7f0c0000 0x8000 -acx
Wait for auto-negotiation complete...OK
100MB - Full Duplex
DHCP DISCOVER...
DHCP REQUEST...
DHCP ACKed...
IP Address. . . . . : 10.3.28.115
Subnet Mask . . . . . : 255.255.0.0
Default Gateway . . . . . : 10.3.1.254
TFTP client: 10.3.28.143
Download OK, file size:950,864

Flash programming ...

bootloader > ls
Image: 0 name:BOOT INFO base:0x7F010000 size:0x00000038 exec:0x7F010000 -f
Image: 1 name:romfs base:0x7F020000 size:0x0009D400 exec:0x00D00000 -ac
Image: 2 name:linux base:0x7F0C0000 size:0x000E8250 exec:0x00008000 -acx

bootloader > _
```

The status bar at the bottom shows: Connected 00:01:44 | VT100 | 115200 8-N-1 | SCROLL | CAPS | NUM | Capture | Print echo



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1.6 FAQ's

- Q: Why does the boot loader hold on flash programming and stop to response my command when I download an image into flash?
- A: If the flash has unknown data, it may cause the flash programming failed. You can use the “del -all” command to erase all flash blocks if you find any flash programming failed condition.
- Q: Why does my image not work after download into the platform by TFTP?
I am sure the image is ok!
- A: Please make sure that the tftp client is in binary mode. In windows, you must use –i option to switch to binary mode. In linux, you must use bin command of tftp client to switch to binary mode.